KNOWLEDGE

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Heywoods 3/-

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Z ZOOS

This Hippo House at the Colorado Mountain Zoo in America is typical of modern zoo architecture

THE world's first zoo was started by Queen Hatshepsut of Egypt in 1494 B.C. During her reign several expeditions were made to the land of Punt (probably Somaliland) to collect strange creatures and plants for it. According to hieroglyphic inscriptions at Thebes, she assembled a variety of animals, including giraffes, elephants, lions, leopards, and monkeys, and displayed them in a park filled with sycamores and incense trees. The Roman emperors, too, collected wild animals which were often paraded in state processions and made to fight each other (and Christians) in the Roman arenas.

During the Middle Ages, and indeed until the 19th century, many European rulers had their own private menageries: there was a famous one at Versailles which was organised by Buffon, the naturalist, on a scientific basis, but this was destroyed during the French Revolution.

In 1826 the Zoological Society of London was founded to promote the 'advancement of zoology and animal physiology and the introduction of new and curious subjects of the animal kingdom'. Two years later the London Zoo, the prototype of all scientific and educational zoos, was opened to visitors (and it was to describe the London zoological garden that the word 'zoo' was first used).

Today there are more than 400 zoos, and most capital cities have a zoological garden.

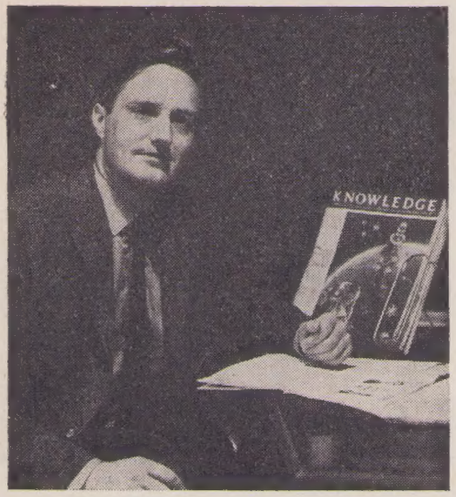
MANY ARGUMENTS HAVE BEEN ADVANCED FOR AND AGAINST ZOOS. HERE ARE SOME OF THE MOST COMMON:

FOR	AGAINST
The life of an animal is more secure in a cage; it is less liable to disease and has a regular supply of food. In the wild an animal may appear free; in fact it is kept inside the boundaries of its own territory (which can be very small) by its enemies and by absence of suitable food. Moreover, zoos are not purely for the gratification of humans. They have an important role to play in preservation. The Père David deer, the Mongolian wild horse, and the European bison exist only in captivity, and rare species like the Arabian oryx are being preserved from extinction by zoos.	Cages are similar to prison cells – animals are imprisoned purely for the gratification of human beings.
During the last hundred years a study has been made of the psychological needs of animals in captivity. The provision of occupational therapy has had successful results. Wherever possible animals are kept in pairs or herds, and open-plan zoos are becoming much more common.	It is cruel to keep animals in cages; they need exercise, play, and the company of other animals, which zoos do not always provide.
Research into food has resulted in the vast majority of animals receiving an adequate diet. Change of climate usually has little effect; lions and tigers at Whipsnade are happy in the snow. Most zoo animals' diseases are caused only by old age, and animal hospitals are of a very high standard.	Changes of food and climate are bad for animals, which often become ill.
Methods of capture can be cruel and zoos can be bad, but these are both rare. The best zoos only trade with reputable dealers, who do not allow their animals to suffer.	Methods of capture and transportation are often cruel, and in some zoos the animals are kept in shocking conditions.
A great deal can only be learned by the zoologist from studying animals in zoos – some can even be studied better in zoos; but most important, zoos give the non-specialist a glimpse he would not otherwise have of the variety of the animal kingdom.	To know an animal scientifically it must be studied in the wild – so why have zoos?

Previous page: Chi-Chi, the giant panda at the London Zoo, comes from mountain bamboo forests in China. It is one of the rarest and most valuable animals in captivity.

KNOWLEDGE NEWS
Week beginning 6th October 1963

SPECIAL ANNOUNCEMENT FROM THE EDITOR-IN-CHIEF



An exciting new colour magazine will replace KNOWLEDGE NEWS

MAGAZINES are always changing, and from time to time they acquire a new look. We want to move with the times, and get full value from the growing excellence of colour printing. So we are turning our black-and-white *Knowledge News* into a superb and exciting colour magazine. You will be as proud to keep this new magazine as *Knowledge* itself.

Instead of a weekly *Knowledge News* we shall, in future, be having a special full-size colour quarterly magazine. This, like *Knowledge News*, you will receive free inside *Knowledge*. But unlike *Knowledge News* it will not appear every week, but every 12 issues. **So from next week onwards there will be no 'Knowledge News' inside 'Knowledge' – but at the beginning of January the new colour magazine will appear.**

Many advantages

Our new magazine will have many advantages. First, by the use of colour we will be able to give a much more interesting and vivid treatment to many subjects which in *Knowledge News* we have had to portray in black and white. We will also be able to give you large colour pictures. It will be possible for you to take these out and put them on your walls.

Moreover, with the greatly increased number of pages in our colour magazine, we will be able to cover subjects which we could not have had in *Knowledge News* before. For instance, we will give you advice on getting a job and tell you what jobs are open to you; there will be short stories by your favourite authors; longer features on controversial subjects and so on. There will also be features about sport; articles about mysteries and marvels of the world today; tales of great heroism – in fact, a whole collection of fascinating and exciting information. And, in our first issue, there will be the most original historical newspaper yet.

Your favourite features continue

However, this does not mean that we are going to do away with our quiz, competitions, puzzles, 'Do You Know?' and so on. They will be there just the same. We will still be having Letters to the Editor, so please do keep on writing to me. In fact, I want to hear what you would like to see in our new magazine. In future we will pay one guinea for each letter published.

Of course, the cost of colour and increased number of pages means that we cannot bring out our new magazine anything like as often as *Knowledge News*. But I can tell you that when it comes out at the beginning of January, our new colour magazine will have been well worth waiting for.

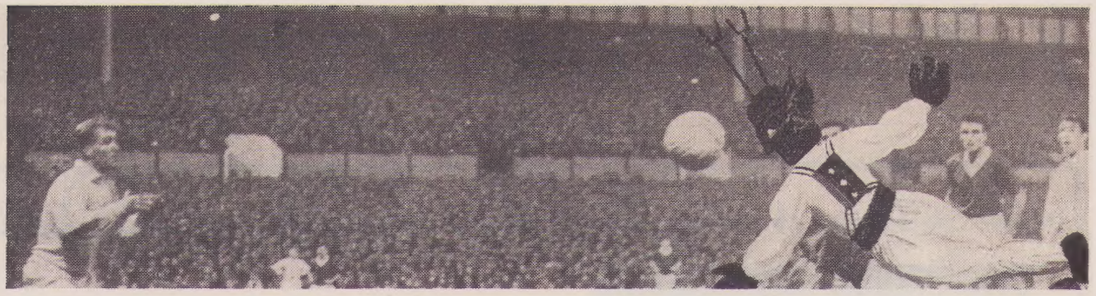
I hope that you will read *Knowledge News* very carefully this week. There are many important announcements about binders, indices, and tables of contents.

So, goodbye until January – I will be writing to you then as Editor-in-Chief of what I hope you will find to be the liveliest and most colourful young people's magazine you have ever read.

John Chancellor

Special competition

THE WORLD v. MARS



PICK YOUR TEAM TO PLAY MARS

Would you choose Pele, the world's most expensive player?

Would you choose Denis Law, Britain's most expensive player?

HERE IS WHAT YOU MUST DO

1. Just suppose that you had been asked to pick an Association Football team to play against a team from Mars. You have all the best players in the world *today* to choose from, and you must pick the most effective team. Who would you choose?

2. When you have picked this team write it down on a letter or postcard giving the positions of the players – if you want to give reasons for your choice of positions the judges will read them with interest.

3. Send your entry to 'The World *v.* Mars' Competition, 37 Hertford Street, London W.1.

4. Your name, address, and age should be included with your entry. There is no age limit for this competition, but age will be taken into account when judging.

5. All entries must be in by 1st November 1963.

6. The winning team will be the one which, in the opinion of the judges, would make the most effective combination. (A team full of individual brilliance does not always accomplish this.)

7. There is one first prize of £10; two second prizes of £5; and three third prizes of £2.

8. The results will be published in January in the first issue of the new *Knowledge* colour magazine.

First Prize £10
2 Second Prizes of £5
3 Third Prizes of £2

RESULTS IN JANUARY IN NEW 'KNOWLEDGE' COLOUR MAGAZINE

Players for a world team to play England on October 23rd have already been chosen. Perhaps you will not agree with the choice of their selectors. You may also want some English players in your team. Anyway, all your ideas, original or conventional, will receive a sympathetic reading from our panel of judges.

ANNOUNCEMENT FOR READERS IN LONDON

Readers living in or visiting London may want to visit our special 'Knowledge' stand which has just been opened at Waterlows, 107 Park Lane. Visitors are welcome between 9 a m and 5.30 p m. They will find a complete range of all back numbers, bound volumes and binders, and the Manager, Mr Turner, will be pleased to assist with advice and information. The nearest tube station is Marble Arch.

Gift subscriptions can be mailed to any part of the world.

For readers of BLACK Knowledge

Alphabetical Volume 4 (A-Z)

For full details see page 3

For all readers

For news about insertions and forthcoming announcements see page 4

'KNOWLEDGE' PROGRESS REPORT

Here is a report on the progress you have made in collecting your *Knowledge* encyclopaedia of 16 volumes plus four volumes of alphabetically arranged cover articles. The volumes you have already collected are in bold type; the one you are collecting at present is in italic type; and the volumes you have not yet collected are in plain type.

BLUE Knowledge readers	**1**	**2**	**3**	*4*	5	6	7	8	9	10	11	12	13	14	15	16
					A–I	J–O				OR–Z		A–Z				
YELLOW Knowledge readers	**1**	**2**	**3**	**4**	**5**	**6**	**7**	*8*	9	10	11	12	13	14	15	16
					A–I	*J–O*				OR–Z		A–Z				
BLACK Knowledge readers	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	*13*	14	15	16
					A–I	J–O				OR–Z		*A–Z*				

An Australian dingo attacking a kangaroo; the kangaroo is larger and faster, but this surprise attack will mean its death

CANINES

WHEN the English explorer William Dampier landed on the west coast of Australia in 1699 one of the animals that he noticed was a kind of wild dog, and he was struck by its ferocity compared with the other Australian animals. None of these animals could successfully escape or resist these dogs, although the kangaroos were bigger and faster.

These animals were dingoes, typical members of the dog family or CANIDAE. They were probably brought to Australia by the aboriginal people, thousands of years ago.

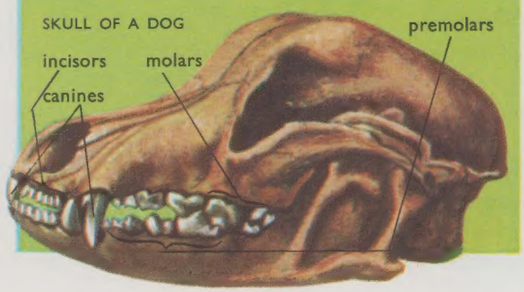
Members of the dog family are found in most parts of the world. Nearly all of them are flesh-eaters and live by hunting. None of them can climb, unlike the cat family, but they are swift and tireless runners. Their teeth are their chief weapons and some kinds hunt in packs, which enables them to overcome animals much larger than themselves. Some of the smaller ones, like the fox, live in burrows.

Teeth for fighting: feet for running

Members of the dog family are collectively called *canines*. Their teeth are typical of the carnivorous mammals. Their canine (or 'dog-like') teeth are long and sharp, and their molars are adapted for cutting flesh. Their feet, unlike those of cats, do not serve as weapons, and their claws are not sharp and curved; dogs' feet are designed for running. They will, however, use their fore limbs to hold on to a victim which they are biting.

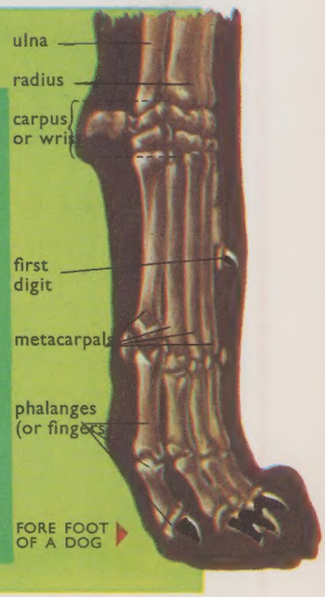
THE TEETH

With a few exceptions canines have 42 teeth: 12 incisors, 4 canines, 16 premolars, and 10 molars. Two pairs of molars are in the upper jaw and the other three pairs in the lower. The last premolar and first molar of each act like scissors to cut flesh into pieces.



THE FEET

Like most fast-running animals, canines stand on the tips of their toes. Although the hind feet have the normal five digits, the inner claw of the fore feet (the so-called dew-claw) is reduced to a vestige and does not touch the ground (see page 1374). Unlike cats, dogs cannot sheath their claws, which are blunted by the ground.



A few of the different types of canine found in the world

CLASSIFICATION

Canines belong to the Order Carnivora and to the Class Mammalia. The family is divided into 12 genera, and some members of four of the genera are described in detail below.

GENUS	SPECIES
Canis	dingo (dingo)
Canis	lupus (wolf)
Canis	familiaris (domestic dog)
Canis	aureus (jackal)
Canis	latrans (coyote)
Vulpes	vulpes (common fox)
Megalotis	zerda (fennec fox)
Lycaon	pictus (Cape hunting dog)

SOME TYPICAL CANINES

DINGO (*Canis dingo*). This is a pale reddish-brown (see previous page). It is found in Australia but is almost certainly not a member of the original or indigenous fauna. Probably the aboriginal Australians brought it with them when they invaded the continent from Asia thousands of years ago; since then it has become a wild animal. Dingoes have now been exterminated over wide areas of Australia because of the damage they do to sheep farming. Some zoologists think that the ancestor of all domestic dogs was an animal very like the dingo.

WOLF (*Canis lupus*). This is the largest of the wild canines and may stand 33 inches high at the shoulder. Its fur is usually grey with a slight reddish tinge, but in Greenland and Siberia the wolves are white. Black wolves occur in the southern United States. Wolves hunt in packs in winter. They will attack and kill large animals such as deer, sheep, and cattle, although they seldom attack men. In spring and summer the packs break up and the wolves separate into pairs to breed.

They are found in Europe, Asia, and North America, but have been exterminated over most of Europe. Wolves still lived in Scotland and Ireland in the 18th century.

DOMESTIC DOG (*Canis familiaris*). All domestic dogs are regarded as belonging to one species, although they are more varied in appearance than all the wild members of the Canidae. This diversity has been brought about by the control exercised by man over their breeding. Breeds of dog have been produced for many different purposes – for hunting, herding, and protecting sheep and cattle, and, especially in recent times, as pets and companions for man. Dogs have been domesticated from very ancient times, and their remains are found with those of Stone Age man. Their origin is still a mystery. Some maintain that the wolf is the ancestor of the domestic dog, others say that it originated from a wild dog similar to the dingo but now extinct.

JACKAL (*Canis aureus*). The jackal is a yellowish-grey animal found in North Africa, India, and westwards from India into southern Russia. It is extremely noisy and will howl all the night through, making sleep impossible for people who are not used to it. Jackals

are shown here, including three breeds of domestic dog

will kill young sheep and goats and raid chicken-runs, but they do not attack large animals and are afraid of man. They will also eat carrion and even berries and fruit. It is sometimes said that the jackal contributed to the ancestry of the domestic dog, but this is unlikely, as its skull and teeth are different from those of domestic dogs.

COYOTE (*Canis latrans*). The coyote is a kind of small wolf that was once very abundant on the prairies of North America. It lives on birds and small animals and will feed on carrion and fruit as well; in fact its feeding habits are very similar to those of the jackal.

Coyotes can be tamed more easily than most of the wild canines.

COMMON FOX (*Vulpes vulpes*). The fox is the only wild member of the Canidae that survives in thickly populated countries like Britain. It is found all over Europe and extends into Asia, and has been introduced by man into Australia, where it is now regarded as a pest. Foxes are a great nuisance to poultry farmers, but they eat large numbers of mice and also prey on rabbits, birds, and frogs. The North American red fox is slightly larger than the common fox. The fur of coloured varieties, such as the silver fox and platinum fox, is very valuable, and these animals are now bred in captivity for the sake of their fur.

FENNEC FOX (*Megalotis zerda*). This is the smallest of the canines, standing only 8 inches high at the shoulder.

It is a pretty little animal with very large ears and sandy-brown fur. Fennec foxes are desert animals, found in Arabia and the Sahara. They prey on small mammals, birds, and insects, hunting at night. During the heat of the day they shelter in burrows. They can be tamed and make attractive pets.

CAPE HUNTING DOG (*Lycaon pictus*). This is one of the strangest-looking of the wild canines, and also one of the largest, standing 25 inches high at the shoulder. The coat is marked with black, white, and brown, and the pattern is quite irregular, hardly any two being alike. The ears are large and rounded and the tail bushy. Cape hunting dogs are found in the open savannah country of Africa. They hunt in large packs of 30 or 40; their usual prey is antelope of various kinds, but they will also kill sheep.

NOTE: for the sake of convenience the canines in the picture are all shown together in one landscape. In reality, of course, they inhabit different parts of the world.

WATERLOO

THE message reached Vienna during the night of 7th March. It read, 'The English commissioner Campbell has just entered the harbour inquiring whether anyone has seen Napoleon at Genoa in view of the fact that he had disappeared from the island of Elba'. This information had an explosive effect on the European statesmen who had gathered in Vienna in that spring of 1815 to celebrate the great victory over Napoleon, which had resulted in the restoration of Louis XVIII to the French throne, and the banishment of 'the little corporal' to the island of Elba.

Within a few days the Allies had decided what to do. Napoleon, they declared, 'had placed himself outside the pale of civil and social relations'. His attempt to regain his kingdom must be crushed. The hero of the Peninsula campaigns against Napoleon, the Duke of Wellington, was invited to go from Vienna to the Low Countries and take command of the allied forces which would gather in one final effort to end the Napoleonic threat to Europe.

Wellington reached Brussels on 4th April. Although Louis XVIII and his family quickly fled into exile, and the French people enthusiastically welcomed Napoleon, Wellington at first seriously underestimated the growing menace. He seemed content to enjoy himself at Brussels, taking few precautions for his troops and attending many dinners and balls.

But if Wellington was desultory Napoleon was in deadly earnest, and immediately prepared to lead France once more to victory. Rapidly Napoleon added 80,000 men to the standing army of 160,000 and set about appointing his commanders. Yet his choice of leaders was perhaps the main reason for his ultimate defeat. Soult, his Chief of Staff, and Grouchy, who commanded his right wing, were completely without experience in the positions allotted to them; while Napoleon himself admitted that Ney, in command of the left wing, had as little strategic ability as the 'last joined drummer-boy'.

Napoleon decided to take the initiative against the British and Prussians at once. Wellington's command consisted of 110,000 of his own men (about half British, the rest from Holland, Belgium, Hanover, and Brunswick), and 117,000 Prussians under their Commander-in-Chief Blücher. Wellington's men, with 200 guns, were holding the fortified posts on the Belgian frontier from Ostend to Mons. Blücher's men, with 300 guns, were quartered at Charleroi, Namur, Dinant, and Liège.

Wellington was entirely ignorant of Napoleon's plans to attack both himself and the Prussians, and regarded his task as a defensive one – waiting until the Austrians and Russians were in the field.

A nasty shock

It came as a complete surprise to Wellington when Napoleon marched into Charleroi on 15th June. The Prussian troops fell back, and Blücher concentrated his army at Sombreffe, near Ligny. He awaited word from Wellington. Wellington issued some preliminary orders to block the roads leading from Mons and Antwerp to Brussels. Then, on that night of 15th June, he went to a fabulous ball given by the Duchess of Richmond. Had Waterloo been lost, his attendance at this ball and his apparently frivolous reception of the news of Napoleon's advance would have shattered his reputation, and earned him universal condemnation.

The following morning Wellington rode to Quatre Bras where his left wing under the Prince of Orange was drawn up. Then he rode on to Sombreffe. He looked at the positions in which Blücher had placed his men and said: 'Every man knows his own troops best, but if I were to

Napoleon leaves the battlefield with his once-mighty army in full flight

place my men where you have placed yours I should expect them to be beaten.' Later Wellington remarked that he expected the Prussians to be 'damnably mauled'.

At two o'clock that afternoon Ney attacked Wellington at Quatre Bras and half-an-hour later Napoleon engaged the Prussians. A misunderstanding sent the First Corps of the French army under Erlon marching across the French lines and back again, instead of marching forward against either of the enemy armies. The result was that while Napoleon beat the Prussians out of Ligny, Ney, without the help of Erlon, failed to drive the British from Quatre Bras.

Yet Wellington, because of Blücher's defeat, decided to retreat himself, and was only able to do so unmolested because of the tardiness of Ney. Meanwhile Grouchy and the cavalry were sent in pursuit of the Germans. But Napoleon did not know which way the Germans had gone, and, assuming that they had fallen back east towards Germany (which they had not), sent Grouchy with 33,000 men and 96 guns marching in the wrong direction.

Wellington had decided that he would make a stand against the French if Blücher would support him. Late on the 17th he heard that Blücher would send an army under Bülow, followed by further troops. This was enough. He decided to accept battle in anticipation of Bülow's arrival and drew his men up in a field near the little Belgian village of Waterloo.

Napoleon's final stand

As night fell on 17th June the French army, with 72,000 men and 240 guns, drew up less than a mile from Wellington's 68,000 men and their 156 guns. The field was small, measuring at its extremes $2\frac{1}{4}$ miles by 4 miles. It was cut in half by the Charleroi–Brussels road. At its south and north ends were low ridges separated by a shallow valley falling perhaps 45 feet. Wellington's men were positioned along the north ridge. But instead of lining the top of the ridge he placed his troops in the rear of it where all they had to do was lie down to avoid the French preliminary bombardments. Then, as the French columns advanced, Wellington planned that they should stand up, advance a couple of paces, and fire a volley into the midst of the enemy.

Torrential rain fell on the night of the 17th, and the field was so waterlogged that Napoleon delayed his first attack until 11 am. The initial attack was on the extreme British right. This particular engagement was to last all day; in it the Coldstream Guards and the Third Corps held out while the decisive engagements were fought elsewhere. At about 1.30 pm Erlon's corps of 20,000 men was sent against Wellington's left, but was repulsed. Lord Uxbridge immediately decided to charge with his cavalry and sent Ponsonby and Somerset in pursuit. They swept all before them, routed a section of the French infantry and took 3,000 prisoners. But they had gone too far. In vain

Position of troops at the battle of Waterloo, 18th June 1815

Uxbridge sounded the retreat, but both Ponsonby and Somerset had landed in the thick of the French army, and they and their troops were destroyed.

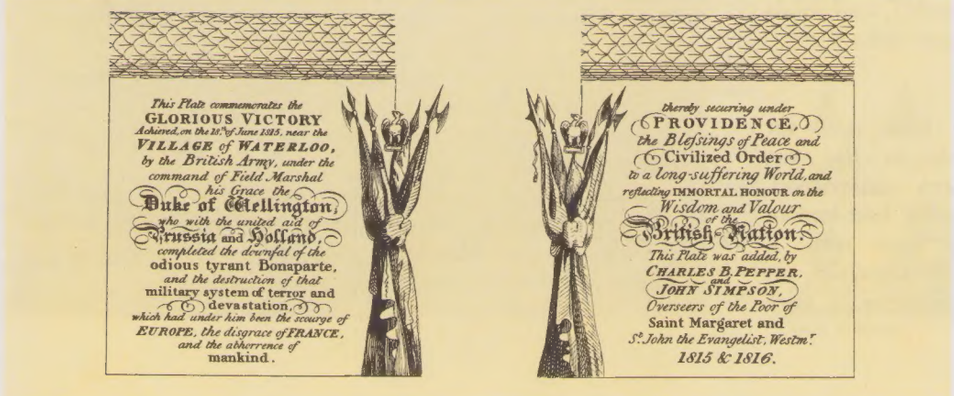
It was now three in the afternoon, and at this point Napoleon received dramatic and alarming news. The Germans had not fallen back at all and were rapidly approaching the French right where they would soon be alongside the British. Napoleon had to beat Wellington before they arrived. He launched an attack on the farm of La Haye Sainte, immediately to the south of Wellington's main line. The farm fell, causing havoc in the British centre. Wellington himself led his Brunswick troops into the gap, exposing himself to extreme danger. To those who clamoured for instructions he replied: 'There are no orders except to stand firm to the last man.'

Britain wins the field

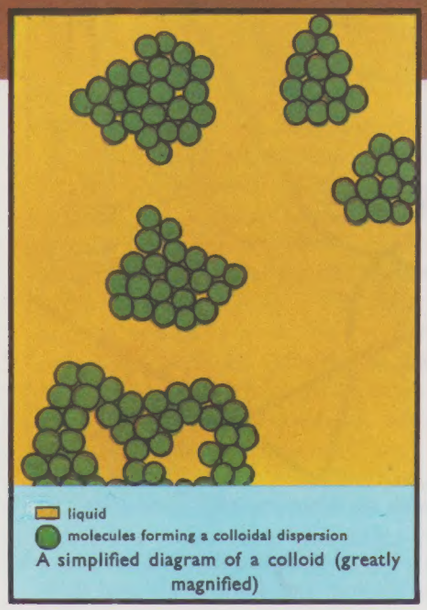
At this critical moment Bülow arrived with his Prussians and took Plancenoit from the French right. Napoleon decided to make his final effort and threw in eight battaolins of the Imperial Guard against Wellington. The dense white smoke of the muskets made visibility bad as these superb troops, veterans of many campaigns, advanced across the battlefield. There seemed to be nothing in front of them. Suddenly Wellington's voice was heard: 'Stand up, Guards.' Then 1,500 of Maitland's Guards leaped forward and poured a devastating blast into the midst of the French. The Imperial Guard were scattered and fled from the field. The French troops were dismayed, demoralised, and panic-stricken. The cream of Napoleon's army was in full flight. Wellington realised that his moment had come. He rode to the crest of the ridge, outlined like a statue in the smoky air. Then he waved his cocked hat towards the French as a signal for advance, and the Hussars and Dragoons surged forward as Napoleon's army fled, leaving their cannons, guns, and ammunition. The field was won. At about 9 p m Blücher arrived, and it was agreed that he should take over the pursuit – a task he accomplished with ruthless efficiency. Wellington retired to a small inn for dinner.

All in all, the British lost 15,000 men at Waterloo, the Prussians 7,000, and the French 25,000. Victory had been costly. But Britain had won more than a battle, she had won the struggle against the tyranny of Napoleon which had lasted for 15 years.

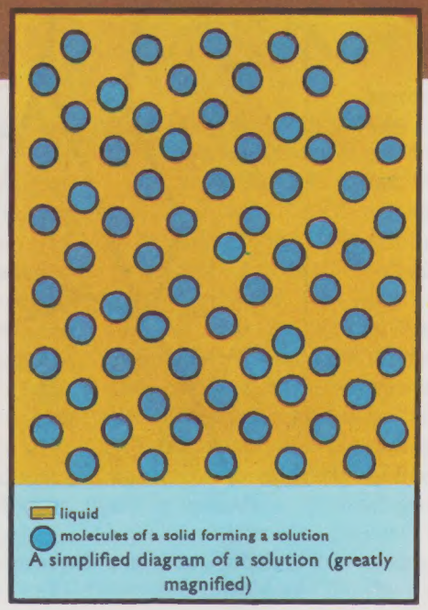
An inscription on a plate struck to commemorate Waterloo



SOLUTIONS AND COLLOIDS



A simplified diagram of a colloid (greatly magnified)



A simplified diagram of a solution (greatly magnified)

WHEN a river in flood breaks its banks, its waters deposit sediments on the surrounding land. The fast-moving waters have stirred up these sediments, which in the still flood waters sink to the bottom again. But not all the substances carried by the water settle immediately. Some may remain suspended in it for days on end, and the smallest particles never sink to the bottom at all.

The particles of various sizes are *dispersed* (scattered) through the water in what chemists call *dispersions*. The coarsest dispersion is a *suspension*, such as chalk dust in water. The next coarsest dispersion is a *colloid*, such as clay in water. The finest and best-known dispersion is a *solution*, such as table salt in water.

Solutions

Put some sugar into a glass of water. After a moment the water will become quite clear again, and there will be no sign of the sugar. The next day the water will look exactly the same. But it must still contain sugar – because it tastes sweet. Look at the liquid through a high-powered microscope and you will see nothing to make you suspect that there is any other substance in the water. What has happened to the sugar? It has divided up into the smallest particles possible – its own molecules. The sugar molecules have detached themselves one from the other, and have spread out evenly among the water molecules.

Chemists say the sugar has dissolved in the water to make a *true solution*. The sugar plays the role of the *solute*, and the water the *solvent*. In general, solute particles are as tiny as a thousandth of a *micron* (one micron=a thousandth of a millimetre) or many times smaller still.

Solutions of solids in liquids, such as sugar in water, are not the only kinds. There are also solutions of liquids in liquids (alcohol in water), gas in liquid (gas in lemonade), and solids in solids (alloys such as bronze, made from copper and tin).

Colloids

Colloids are 'nearly solutions'. They have been used for many thousands of years, but it is only in the last hundred years that their structure has been understood. Butter, ink, rubber, and smoke are among the best-known everyday examples. In a solution, as we have seen, a substance dissolves in another as molecules. In a colloid, on the other hand, a substance is dispersed in another in very fine particles. These particles consist of giant molecules or groups of molecules. Each particle may have tens of thousands of molecules. Their size may be anything between a micron and a thousandth of a micron. In other words, colloid particles are nearly always much bigger than solution particles. Sometimes colloids are caused to *coagulate*; that is, particles join up and form flaky-looking clots which sink in the liquid. You can see this happening in milk which has turned sour. Colloids may be made to coagulate in many ways, such as boiling, applying electric charges, and adding acids.

The word colloid comes from the Greek word *kolla*, glue. Colloids are vitally important to life. The protoplasm in living cells contains colloids; egg-white is a colloid of proteins in water.

The type of colloid made by dispersing one liquid in another is called an emulsion. Examples of emulsions are the fat in water found in milk, and the familiar mixture of olive oil and vinegar to form salad dressing. But not all colloids are liquids. Some are made of solids and gases, such as soap, resin, pumice stone, and clouds.

Size (in microns)	*Kind of dispersion*	*Visibility of particles*	*Sedimentation*
100 – 1	Suspension	Easily visible under microscope	Rapid settling
$1 - \frac{1}{1{,}000}$	Colloid	Visible under high-powered ultra-microscope	Slow settling or none
$\frac{1}{1{,}000}$ or less	Solution	Not visible, even under high-powered ultra-microscope	No settling

SUSPENSIONS

Suspensions consist of solid particles dispersed in liquid. They have a cloudy look because their particles are quite large compared with colloid particles – more than one micron across. The largest particles can just be seen with the naked eye.

Suspensions deposit their particles in the form of sediments. This action explains how deltas form at the mouths of rivers. A typical suspension is milk of magnesia – magnesium compounds in water.

Suspensions and colloids are important in the chemical industry because the particles are finely divided. This makes chemical reactions work much faster, because there is a greater area on which the chemical reaction can work.

FAUNA AND FLORA OF EUROPE

IF we were taken back 2,500 years in time not only would the people around us be living utterly different lives, but even the plants and animals would be different. At that time much of Europe was covered by deciduous forest, in which lived the great wild cattle called aurochs, bears, beavers, bison, and many other animals, while in Greece there were even lions.

But since that time man has destroyed much of the forest, and relentlessly hunted animals. Aurochs have become extinct, and other animals have only been saved from this fate by the policy of protection, adopted in recent years. Most of the larger wild animals such as bears and wolves, which were once common and widely distributed in Europe, are now restricted to wild, mountainous regions or to nature reserves and national parks.

The spread of animals and plants

During the course of history men steadily improved their methods of travelling, especially by sea, so that communications between different parts of the world became easier. One result of this was that animals and plants spread from their native countries throughout the world, for many European animals were taken to other countries and became wild there; examples of these are the rabbit and the sparrow. In the same way various animals have been introduced by man to Europe from other countries. Some have been brought and released deliberately, like the sika deer, the barking deer, and the pheasant, which are all from eastern Asia. The musk rat, a native of North America, was imported into Europe by people who wanted to breed it for its fur. Some of them escaped, and it is now established as a wild animal. Other animals have come as stowaways, mainly on ships; the brown rat and the house mouse are not native to Europe, but originally existed in the wild state in Asia. There are also insects in Europe which have been introduced from overseas; some of them, like the Colorado beetle from North America which destroys potato plants, are a serious menace to agriculture.

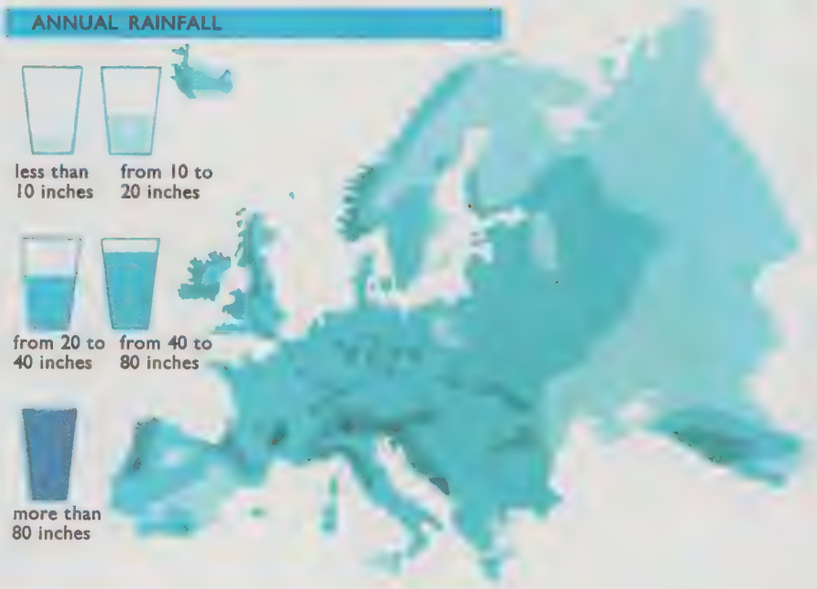
The introduction of plants has been on a far larger scale. Many of the plants used in agriculture came originally from other continents: potatoes, tomatoes, and maize from America, rice and many of our familiar fruit trees from Asia.

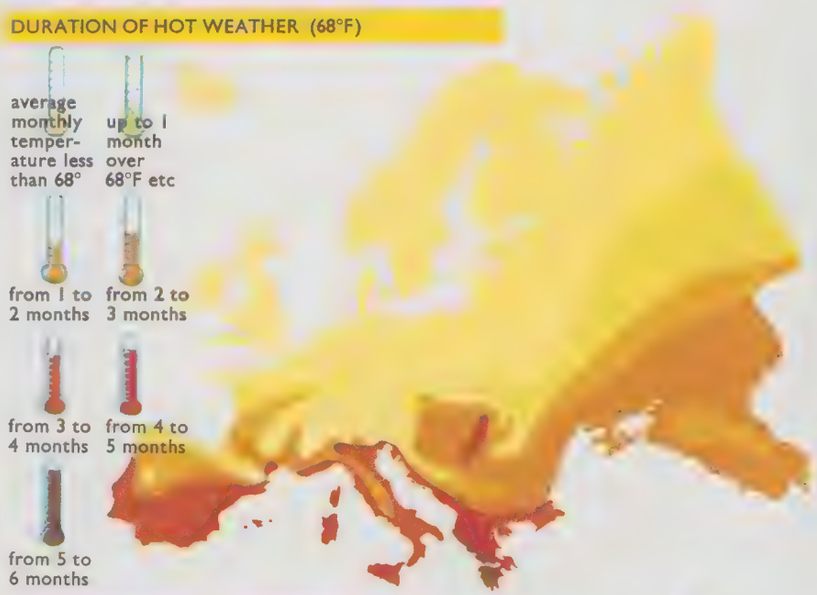
Nearly all the animals and plants included in the map on the next two pages are native to Europe, though some of them have been taken by man from one part of Europe to another.

Three faunal and floral regions

Europe can be divided into three climatic zones or regions, each of which has types of animal and plant life characteristic of it. NORTH-EASTERN EUROPE. This region has a continental climate, with long, hard winters, short, warm summers, and rather low rainfall. Its typical vegetation is coniferous forest: where Scots pine is the most abundant tree a good deal of light penetrates to the ground and a thick undergrowth of bilberry and heather springs up. Fir trees, such as spruce, shade the ground so effectively that very little can grow beneath them. North of the forest is the very cold region known as the tundra. Here mosses and lichens form the main vegetation, and there are no trees.

The forest is inhabited by elk, lynx, wolves, and many other mammals and birds. On the tundra the reindeer is the only large mammal, and the Arctic fox and snowy owl also inhabit this region. ATLANTIC REGION. This includes northern Spain and France, Germany, Belgium, Holland, and the British Isles. Its climate is maritime (influenced by the sea) and has a high rainfall, mild winters,




DURATION OF HOT WEATHER (68°F)
average monthly temperature less than 68°
up to 1 month over 68°F etc
from 1 to 2 months
from 2 to 3 months
from 3 to 4 months
from 4 to 5 months
from 5 to 6 months

and rather cool summers. The natural vegetation of this region is deciduous forest, consisting of trees like oak, ash, and beech, which lose their leaves in winter. Most of this forest has been destroyed to make way for cultivation; some of the animals which lived there, like the auroch, are now extinct, and other large animals like bears, wolves, and bison, which used to inhabit it, are now rare. Their numbers are still being reduced, and they will only survive if nature reserves are established and maintained to protect them. Most of the familiar birds of western Europe were originally inhabitants of the deciduous forests, as well as many small mammals like foxes, hedgehogs, weasels, and shrews.

MEDITERRANEAN REGION. This is the region lying south of the main southern European mountain chains, which run from the Cantabrian Mountains of Spain through the Alps to Albania. The summers are hot and dry, the winters mild and wet, and many of the trees are evergreens, like the olive, laurel, cork oak, and several species of pine. Citrus trees, like oranges and lemons, also grow well in this climate. The animals are, in general, like those of the Atlantic region, but there are some which do not occur north of the mountain chain, such as the genet and porcupine, and the only wild monkeys in Europe are the so-called Barbary apes of Gibraltar. The flamingo is found in Europe only in this region, and reptiles are more numerous and varied than they are farther north.

A great many migratory birds spend the winter in Africa and fly north, across the Mediterranean into the Atlantic region and even into north-eastern Europe to nest in the spring. Some insects also migrate; the death's-head hawk moth regularly flies from North Africa as far as Britain and southern Scandinavia.

fulmar petrel
velvet scoter
reindeer
snowy owl
birch
Arctic fox
guillemot
black grouse
myrtle
elk
wolverine
white-fronted goose
capercaillie
lynx
waxwing
birch
fox
wolf
spruce
Scots pine
bullfinch
red squirrel
marten
birch
brown bear
grey-lag goose
hawk owl
grey seal
brambling
Russian blue tit
spruce
oak
roe deer
rough-legged buzzard
crossbill
wild boar
shrew
black stork
willow
peregrine falcon
hare
juniper
bison
oak
red-footed falcon
red deer
hare
Pallas's sand-grouse
hooded crow
pallid harrier
larch
larch
badger
common souslik
sunflower
great bustard
brown bear
Austrian pine
mole
spoonbill
pelican
imperial eagle
Aesculapian snake
wild lilac
hedgehog
large egret
cypress
broom
Serbian spruce
wolf
sturgeon
red-legged partridge
Greek tortoise
horse chestnut
griffon vulture
green lizard
olive
sandwich tern
agave
dolphin
flying fish
wolf
Note: these drawings are not drawn to the same scale

PREHISTORIC MAN

Boys of the Palaeolithic Age being taught by one of the wise men of their tribe

WHEN we talk of prehistoric man we are often referring to two quite separate things. First we mean the man himself, his size, skull formation, and so on. Secondly we mean the way he lived, what he ate, and what he used for shelter and warmth. The term prehistoric man does not refer to one particular creature, for during the hundreds and thousands of years of man's 'pre-history' he evolved from something resembling an ape (the earliest Palaeolithic) to something approaching ourselves in physique and mental capacity.

There is evidence of man on the earth dating from about half a million years ago; part of a skull was found in 1890 in Java dating back approximately half a million years. Anthropologists call this skull the remains of 'Java Man', and it is interesting that the cranium is only about half the size of the average human one today. There were no tools found on the site, although 'Java Man' had probably learned how to make tools. In 1929 'Peking Man' was discovered; the find consisted of relics of a skull dating from a time perhaps 200,000 years after 'Java Man'. His cranium was about three-quarters the size of ours, and primitive tools were discovered in the neighbourhood of the find.

Unlike other prehistoric discoveries such as the numerous remains of later Palaeolithic (35,000 to 8,000 years ago), Mesolithic (8,000 to 4,000) and Neolithic man (4,000 to 2,000) (see page 641), these earliest men were physically quite distinct from ourselves; that is, they did not belong to the species *Homo sapiens*, a term applied to man from the later Palaeolithic Age. By this later Palaeolithic Age, represented in our illustrations, man had discovered how to make flint tools and weapons, and to skin animals for clothing.

Yet despite these great changes it is still possible to speak of the 'life of the prehistoric man', for in some ways conditions remained unaltered even during half a million years. Man was, and remained, a nomadic hunter right up until the end of the Stone Age, while his social organisation remained primitive and his problem continued to be to eke out a precarious existence in the face of the weather, animal predators, and disease.

In constructing a picture of prehistoric life we might remember that if we were suddenly plunged into the prehistoric age we should find ourselves living a life not very dissimilar from that of our early ancestors.

TRIBAL LIFE

Late Palaeolithic man's life was one long struggle with nature; he had at the same time to live off it and protect himself against it. Most of the men of a tribe spent their lives hunting; but in each tribe there were one or two elders or 'witch doctors' whose job it was to look after their fellow men. They knew the natural signs which meant good or bad weather, the phases of the moon, and the different seasons. They helped their tribes find water and plants to eat. They were supposed to control the rain, and they even helped to cure diseases. It was the wise man's job to see that hunting was good. Special ceremonies would be held, often deep down in caves where wild dances and mysterious rites would be performed. Remains of such a ceremony were discovered far underground at Montespan in France in 1922. The cave walls were engraved with animal pictures, and in the centre of the floor were imprints of dancers' feet and a number of clay statues of bears, lions, and horses. These were riddled with spear holes, and it is clear that 'sympathetic magic' had been practised; the hunters hoped that by 'killing' clay models they would be successful in killing real animals.

Tribal hunting rite in an underground cave in the late Palaeolithic Age; note the witch doctor

on the right and the pictures of bison on the walls

SIGNIFICANT SKULLS

1890–1891; Eugene Dubois discovered fragments of a skull in Java. About half the size of a modern cranium, it was named 'Java Man', and its age was estimated at nearly half a million years.

1929; in limestone caves near Peking part of a skull of 'Peking Man' was found by Dr Pei. This skull was estimated to be 300,000 years old, and by 1936 three similar skulls had been found in the same area. The cranium was about three-quarters of the size of a modern skull, but all the Peking specimens were lost in the early stages of the Sino-Japanese war.

1935–1936; in the Swanscombe gravel pit near Gravesend two skull bones about 200,000 years old were found by Dr Marston. The cranium was larger than 'Peking Man' and more like that of modern man.

1947; at Fonté Chevade, in France, Miss Henri-Martin discovered bits of two skulls perhaps 100,000 years old.

1954–1955; in Algeria 'Ternifine Man' was discovered near Oran. The find consisted of three jaws, teeth, and a part of a skull. The estimated age was 300,000 years, and 'Ternifine Man' was physically similar to 'Peking Man'.

1957–1959; Ralph Soleki discovered almost complete skeletons of Neanderthal man (perhaps 70,000 years old) in northern Iraq. Formerly this man was thought to have been confined to western Europe. His physique was similar to modern man.

1960; in Olduvai Gorge in Tanganyika Professor Leakey discovered an almost complete skull of 'Chellean Man'. This man was as old as 'Peking Man' but slightly bigger, and tools were found with the discovery. The significance of these African discoveries is that they show that very early man rapidly distributed himself from Central Asia at least as far afield as North Africa.

HE LIVED BY HUNTING

We know that Palaeolithic man was a hunter both from the great quantities of animals' bones found with his remains and from the wonderful pictures which he drew on the walls of caves in France and Spain; indeed hunting was the centre of his life.

At that time bison, wild horses, and deer were abundant in Europe, and there were lions too, so that Stone Age man was not only a hunter but was hunted as well. Some of the animals he pictured in the caves became extinct before the dawn of history. These include the great hairy mammoth, which was a cold-weather elephant, and the enormous cave bear.

FEAR OF DEATH

Few Palaeolithic people lived for more than 40 years. Those that survived infancy were killed by animals or accidents; very rarely did they die of old age. Stone Age people must have found death very hard to understand. They used to rub red ochre on to the bodies of their dead in the hope of bringing back their living colour. A skeleton, treated like this, was found in a cave at Paviland, South Wales.

Artist's impression of the burial of the Paviland Cave man. His body has been covered with red ochre to suggest that he is still alive. When the skeleton was discovered it was thought to be that of a woman, and it is still called the Red Lady of Paviland

PLANTS IN THE HOUSE

ANYONE who buys an indiarubber plant in the expectation of an annual crop of ink and pencil erasers is certain to be disappointed. *Ficus elastica* does not bear indiarubbers. But it does bear large and fascinating leaves, and for this reason many people like to keep one of these plants in their homes.

Plants like the indiarubber plant, which will live indoors indefinitely, are known to florists and horticulturalists as *house plants*. They are mostly rather rugged species which can survive in the shadowy conditions found inside many houses. What is more, they can tolerate the dryness of indoor air and a certain amount of tobacco smoke.

Unfortunately few house plants have colourful flowers, and so most florists sell many other species which are notable for the brightness of their blooms. These plants do not survive indoors indefinitely, but at least they live long enough for their flowers to be well displayed. These *indoor plants* are brought into flower in hot-houses where there is enough light and warmth for their development.

PLANTS FROM THE TROPICS

Most of the plants which are used to decorate the interiors of buildings come either from tropical or sub-tropical countries. There are two good reasons for this. The first is that because house plants are kept indoors indefinitely they must necessarily be evergreens. Few people would care to look at bare stalks for several months each year! Unfortunately there are few evergreen plants in the temperate regions which are suitable as house plants, and florists have therefore had to look further afield.

The second reason for choosing tropical and sub-tropical plants is that the blooms of the flowering species are often so bright and colourful. Those species which can be persuaded to flower indoors are therefore very attractive to florists and householders alike. Even if the flowers last only a few days, they bring a glow of warmth to the dullest day and well repay the small amount of attention that they need.

THE POTS

When plants are grown in a greenhouse it is usual for them to be kept in the familiar red clay pots. These pots are inexpensive and easy to replace. Clay pots, however, are not suitable for use in the house. They are unsightly and any excess water drains out through the hole in the bottom. To overcome these disadvantages many other kinds of 'pot' have been devised, and florists sell an attractive selection in glazed earthenware, plastic, and fibreglass.

Indoors small plastic pots have largely superseded the porous clay variety

THE SOIL

If plants are to grow well in pots it is essential that they should have the right kind of soil. Earth from the garden is seldom suitable for potted plants, and, because of this, many special mixtures, usually called composts, have been devised. One of the most popular is the mixture known as John Innes Potting Compost Number 2, developed by the John Innes Institute; it is made of seven parts of loam, three parts of moss peat, and two parts of coarse sand. To each bushel are added 8 ounces of John Innes Base Fertiliser (made up of two parts of hoof and horn meal, two parts of superphosphate of lime, and one part of potassium sulphate), and 1½ ounces of chalk. When a compost is needed for a plant which cannot tolerate lime, the chalk is replaced by sulphur.

TEMPERATURE

Since most of the plants used inside houses are of tropical or sub-tropical origin, it is not surprising that they are *frost tender*. For this reason it is important that the temperature of a room in which plants are kept should not fall below freezing point.

WATERING

The knowledge of when to water, and how to water, can be learned only by experience. In hot weather plants in small porous pots need to be watered daily. During the winter, however, watering once a week is usually enough. Plants in glazed pots need to be watered only about half as often as those in porous pots, because water cannot escape through a glazed pot and there is no hole in the bottom through which the water can run to waste.

HUMIDITY

Most plants like humid conditions. They then lose less water from their leaves and in consequence look crisper and healthier. Inside houses, particularly those with central heating, the dryness of the air may severely damage delicate plants. These illustrations show two ways of keeping the air near plants humid.

When a plant in a porous pot becomes very dry the best way to water it is to place the pot in water and to leave it there for about five minutes.

The automatic watering system shown above is used in non-porous pots with holes in their bases. By capillary action water travels up the wick placed in the hole.

Pandanus veitchii; this plant is a tropical evergreen. It belongs to the group of plants known as 'screw-pines' because of the spiral way in which the leaves radiate from the stem. The aerial roots tend to lift the whole plant out of its compost.
Aechmea fasciata; this strange plant is only one of the 100 species of *Aechmes*. It can be cultivated successfully only if placed in a position with plenty of light.

Senecio cruentus

Euphorbia pulcherrima

Pandanus veitchii

Monstera deliciosa

Aechmea fasciata

Begonia rex

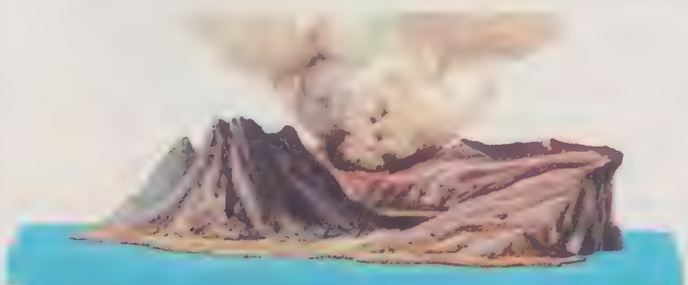
Begonia rex; this plant is grown for the beauty of its foliage. The white markings on the leaves make it particularly attractive as indoor decoration.
Senecio cruentus; Cineraria is the popular name for this plant. The genus is particularly favoured by amateur gardeners, for it can be grown very successfully in unheated greenhouses.
Euphorbia pulcherrima; well named 'the most beautiful', the attractive colours of this plant are due, not to the small yellow flowers, but to the vermilion bracts around them.

Monstera deliciosa; this tropical evergreen refuses to grow unless centrally heated.
Ficus elastica; the indiarubber plant is one of the toughest of all house plants. For this reason it is much used in cafés and coffee bars.

Ficus elastica

ON 24th August AD 79 one of the worst natural catastrophes in history overtook the city of Pompeii in southern Italy. The peace of this prosperous Roman holiday resort was brutally shattered when the nearby volcanic mountain Vesuvius erupted and buried the city alive. We have an eye-witness account of this horrific disaster from the younger Pliny, whose own uncle was suffocated by poisonous gases while trying to rescue the victims. He tells how a monstrous, mushroom-shaped cloud appeared above Vesuvius, overshadowing the towns of Pompeii, Herculaneum, and Stabiae; for three days lava and hot ashes rained from this cloud and few survived this scorching, searing shower. Vesuvius then sank into comparative inactivity for over 1,500 years, but in 1631 it reawoke – this time killing about 18,000 people – and has never since subsided completely.

Disasters such as these will only be avoided when scientists are able accurately to predict eruptions. But although some volcanoes like **Stromboli** are constantly active, many are dormant for a thousand years or more and so no cycle can be worked out. A volcano cannot be presumed to be extinct unless there is clear evidence that no eruption has occurred for 2,000 to 3,000 years. Not only do long-quiescent volcanoes suddenly come to life, but new ones are sometimes formed, like **Giulia,** which made a brief appearance above the sea off Sicily in 1831. A volcanic eruption occurs when hot gases and lava, in contact with deep molten rocks (*magma*), burst through a split (*vent*) in the earth's crust. This can happen above or below sea-level. The debris can either be spread far and wide and so form plateaux or, as is more common, pile up locally to build hills or mountains. Most European volcanoes, both active and dormant, seem to follow lines of stress connected with the last period of folded mountain formation; but as yet the precise nature and causes of volcanic eruptions have not been fully understood.

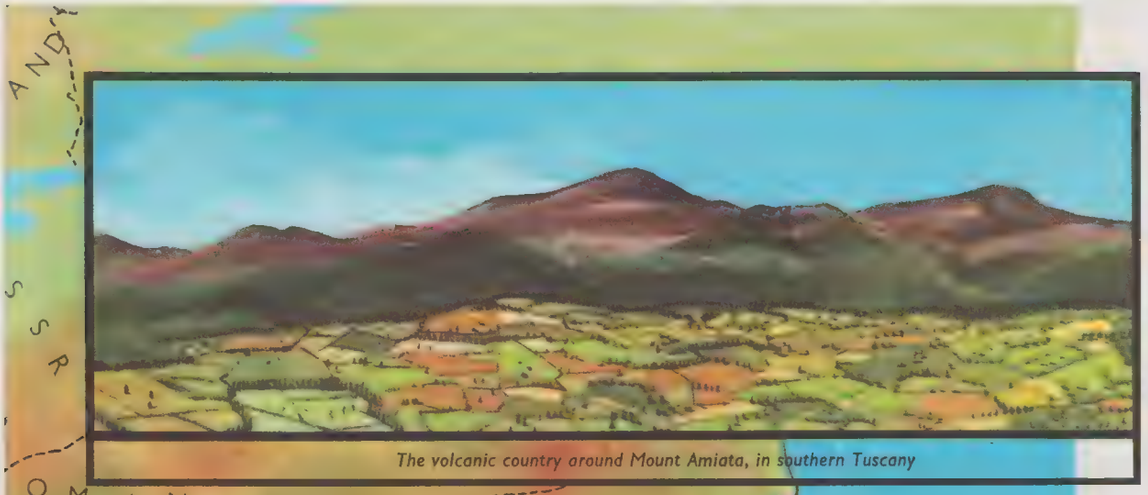


The island of Giulia, in the Sicilian Sea, was produced by volcanic eruption in July 1831, only to disappear a few months later

Italy

Western Italy from Tuscany to Sicily is littered with groups of volcanoes both active and extinct, the two most famous active ones being **Etna** and **Vesuvius.** Mount Etna, near Taormina in Sicily (see page 1902) is, at 10,705 feet, the highest volcano in Europe. Vesuvius (see page 1361), to the south of Naples, is an almost perfect cone rising to 3,891 feet, with a circumference of 25 miles at the base. It is crowned by a great crater 2½ miles across, and within this lies the present active cone. Jets of steam and lava flows are a normal occurrence, but after a period of quiescence the volcano is liable to explosive eruptions. The lower slopes of both Etna and Vesuvius are extensively cultivated because the soil is very fertile. Near Vesuvius is **Monte Nuovo,** the New Mountain, so-called because its volcanic ash cone, 455 feet high, was built in the course of a few days during a violent eruption in 1538.

As many as 52 craters have been identified in the area between



The volcanic country around Mount Amiata, in southern Tuscany

The distribution of volcanoes in Europe

A remnant of an ancient volcano at Le Puy, crowned with a church

Mount Amiata and Rome. The ejected material from these craters covers an area of 2,000 square miles, the greatest expanse of volcanic *tuff* (ash and cinders) in continental Europe. Many of the craters now contain lakes, which are roughly circular in shape and often very large, like **Bolsena,** which covers $33\frac{1}{2}$ square miles, and is 479 feet deep.

France

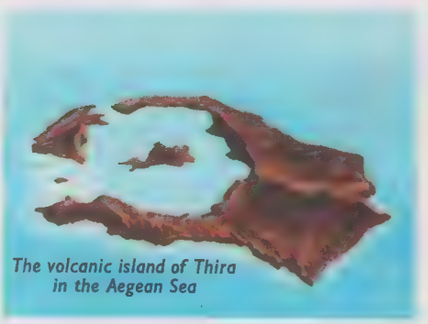
The MASSIF CENTRAL of France was once the scene of intense volcanic activity, and this has left its mark on the countryside today, which, with its numerous cones and craters, resembles a lunar landscape. The present-day relief has largely been shaped by the different types of lava emitted during the eruptions. The dark basaltic lava tended to form plateaux such as that of AUBRAC, while the paler siliceous material was more viscous (sticky) and formed such striking features as the **Puy de Dôme.** The **Puy de Sancy,** 6,187 feet, the highest point of the Massif Central, is itself a volcanic cone. Many of the smaller volcanic hills are crowned with buildings. For example, the volcanic *plug* (the solidified vent of an ancient volcano) of **Polignac** is crowned by a 14th-century tower. The town of Le Puy is famous for the statue of Notre Dame de France on the summit of the ROCHER CORNEILLE, and the church of St Michel on the ROCHER AIGUILLE, both volcanic remnants.

Greece

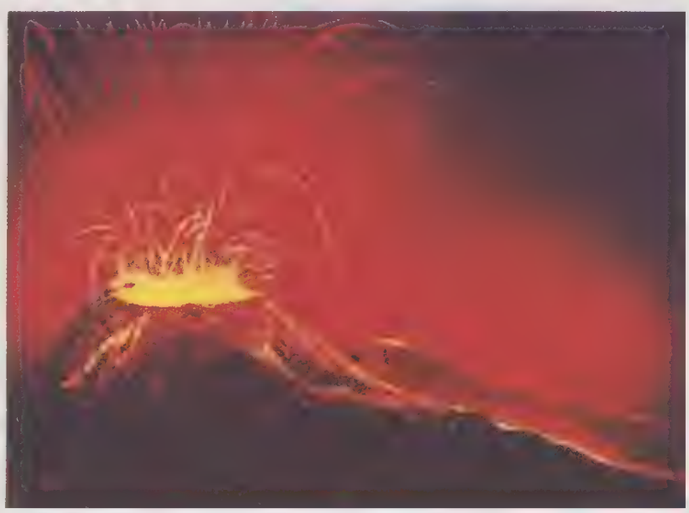
The Greek island of **Thira** is one of the most spectacular of all the Aegean islands because of its strange shape. A hollow truncated cone, broken by large gaps in the west, rises gradually from the outer rim to a height of over 1,000 feet. The inner side of the cone drops precipitously to the sea, forming cliffs of 700 feet. In the centre of the now-sea-flooded crater are the **Kaemeni Islands,** which were formed by eruptions within historic times. Violent eruptions took place in 1866 and from 1925 to 1926.

Iceland

Much of Iceland is covered with lava flows, many of which are geologically very recent, having occurred since the last Ice Age. There have been records of eruptions somewhere in the island in every century during the past thousand years. The most famous Icelandic volcano is **Hekla,** 'the mountain of fire', which Europeans regarded with such horror that for centuries they called it 'the gate to Hell'; it last erupted in 1947. The **Dyngju-fjöll** is chiefly notable for its huge *caldera* (crater), which is over four miles across. There is always the possibility of volcanic activity taking place beneath the ice-fields and glaciers, and this happened to the GRIMSVÖTN glacier in 1934. The streams flowing from the glacier suddenly increased, and within a week a vast torrent was pouring from it. A volcanic eruption was about to take place, and the heated ground had melted the ice. The eruption formed two large craters and filled the valley with lava and hot ash, but two years later the ice was once again advancing down the valley.



The volcanic island of Thira in the Aegean Sea



A spectacular night view of the active cone in the crater of Vesuvius

ARCHBISHOP LAUD

Of God,
Of Man,
Of the Divell.
The least of these, the greatest ought to be.
The other two, of men and of the Devill. Ought to be rooted out for ere as evill.

Printed, and are to be sold by SAMVEL SATTERTHVVAIT

A contemporary cartoon showing (left) a Puritan; (centre) Laud as High Churchman; (right) Laud as a Roman Catholic

AS the condemned man passed on his way to execution he looked up at the little window high in the Tower. There he saw Archbishop Laud, also a prisoner, gazing down on him. Falling to his knees, the man cried: 'Your blessing, my Lord.' Slowly the Archbishop raised his hands and made the sign of the Cross. Then, overcome with grief, he fainted, and the Earl of Strafford, Thomas Wentworth, former President of the Council of the North and Lord Deputy of Ireland, went on his way to the scaffold. Strafford died at the hands of Parliament because of his loyalty to King Charles I. And on that May day in 1641 King Charles and Parliament were only 15 months away from the Civil War which was ultimately to bring the King himself to the block, as well as his other faithful servant, Archbishop Laud.

William Laud was a dedicated man. He had no sense of humour and few friends. He never married. His life revolved around his duty as a minister of the Church and of the King. He was born the son of a humble Reading clothier on 7th October 1573. He was educated at Reading Grammar School, won a scholarship to Oxford, and graduated at St John's College in 1594. In 1601 he became a priest and rapidly gained a reputation for his 'High-Church' opinions, anti-Puritanism, and support for the monarchy. In 1608 he became chaplain to Bishop Neile of Rochester, a man of similar opinions, and in 1611 he became President of St John's College. In 1626 he was made Bishop of London.

Early 17th-century politics were inflamed by religious passions. Laud's career was only beginning when the 'Elizabethan compromise' finished with the Queen's death in 1603. The two extremist groups, Roman Catholics and Puritans, both had high hopes of the new King, James I. But he disappointed them both. He refused to bring England back into the Roman Church and the Catholics responded by trying to blow up the Houses of Parliament on 5th November 1605. Puritan opposition centred on the House of Commons where the Puritans had great influence. They criticised the King at every opportunity, and declared his taxes, like Ship Money and Tonnage and Poundage, illegal. It is hardly surprising that King James thought that 'the Puritans agreeth as well with the monarchy as God with the Devill'. It is also hardly surprising that James, and his son Charles I, sought to surround themselves with men like Laud and Strafford, who, believing that 'no bishop' meant 'no king', became champions both of the monarchy and the 'High Church' with all its trappings of bishops, ceremonies, incense, candles, and sacraments.

The horrified Puritans denounced Laud's influential group as Papists and 'Arminians' (a name derived from the Dutchman Arminius, who had condemned Calvin). Charles I, who succeeded James in 1625, was no more successful with Parliament than his father. In 1629 the House of Commons passed a group of resolutions including 'that whosoever brought in innovations of religion or favoured Popery and Arminianism would be considered capital enemies of the kingdom'.

Rule without Parliament

This was enough for Charles. His father had warned him that he would have his 'belly full' of Parliaments. He did not call another for 11 years, and during that '11-year tyranny' Laud set about imposing his will on the Church.

As a Judge in the Court of Star Chamber, Laud was particularly active. He sentenced Alexander Leighton, the Puritan pamphleteer, to a fine of £10,000, the pillory and the lash at Westminster and Cheapside, his ears to be cut off, his nose slit, and his cheeks branded. William Prynne, an even more active Puritan, received a very similar punishment in 1634. In 1633 Laud became Archbishop of Canterbury. He planned to extend his policy to puritanical Scotland, and in 1637 tried to impose the English Prayer Book north of the Border. All Scotland broke into riots, and Charles decided to implement Laud's policy by war. But he needed money, and for this he needed Parliament. Reluctantly in 1640 he summoned Parliament.

Parliament met in an ugly mood. Dominated by Puritans like Pym and Hampden, it ignored the war and attacked the King. Charles watched helplessly as first Strafford then Laud were impeached and sent to the Tower. In August 1642 Parliament and the King were at war, and Laud's end was only a matter of time. On 31st May 1643 William Prynne (his hair long to cover his lack of ears) was ordered to prepare evidence against Laud, which he did with a malicious pleasure. Yet at the arduous trial beginning on 12th March 1644, Prynne was unable to prove his treason charges, and Parliament had to convict Laud by Act of Attainder. Laud was executed on 10th January 1645 at Tower Hill.

Laud was not the first Anglican martyr, but he was, perhaps, the first Protestant churchman to die at Protestant hands. The rift symbolised by his death, that between high Anglicanism and the Low-Church sects, formed a breach that has remained, though mellowed with time, until our own day.

A contemporary cartoon: Laud 'eating' Prynne's ears

Announcement for readers of BLACK Knowledge

Standard Binder for Volume 13

and

Easibinder for Volumes 13 & 14

AVAILABLE NOW!

THIS week you come to the end of Volume 12. The standard binder for Volume 13, and the Easibinder for Volumes 13 and 14, are available now. See your newsagent right away or, in case of difficulty, write to Department B, 'Knowledge', 37 Hertford Street, London W.1.

The standard binder costs 3s. 6d. and the Easibinder 13s. 6d. There is a 1s. 3d. charge for postage and packing from Department B, but more than one binder can be ordered for the same charge.

Remember – copies are better in a binder.

Inside Knowledge *this week you will find the Title Page and Table of Contents for Volume* 13. *This goes on the first string or rod of your new binder. Next week you will receive the Index for Volume* 12, *which will go on the last string or rod of your Volume* 12 *binder.*

THE END IN SIGHT

You probably realise that the end of your Knowledge *encyclopaedia is in sight. The encyclopaedia will be complete at the end of* 16 *volumes – that is, after* 192 *weekly issues.*

However, there will be another eight weekly issues of Knowledge, *bringing the total published to* 200. *These eight issues will contain a lot of useful information, such as charts, maps, and chronological tables, summing up what has already been covered. These extra issues are not to be bound into any volume; you will keep them loose so that you can refer to them quickly, or use them as wall-charts.*

ALPHABETICAL VOLUME 4 (A-Z)

Standard Binders & Easibinders

AVAILABLE NOW!

THIS week you come to the end of your third alphabetical volume, containing cover articles OR-Z. Binders for the fourth and last alphabetical volume (containing cover articles A-Z) are available now.

They can be obtained in two versions: the standard binder, containing 48 cover articles and costing 3s. 6d.; the more luxurious Easibinder holding 48 cover articles and costing 13s. 6d. See your newsagent right away or, in case of difficulty, write to Department B, 'Knowledge', 37 Hertford Street, London W.1. There is a 1s. 3d. charge for postage and packing from Department B – but more than one binder can be ordered for the same charge.

Inside Knowledge *this week you will find the Title Page for Alphabetical Volume* 4. *This will go on the first string or rod of the Volume* 4 *Alphabetical Binder.*

YOUR LAST ALPHABETICAL VOLUME

Next week you start the final alphabetical volume, containing cover articles running from A to Z.

Many of the articles in this final volume are of a topical nature; they deal with such subjects as Communism, Democracy, Defence, Industry, all of which you should know about to understand life as it is today. This, the fourth and last alphabetical volume, runs from issues Nos. 145 *to* 192.

We are continuing Knowledge *until issue* 200; *that is, publishing eight extra issues. The cover articles of these eight issues will make up a supplement called The World at Work.*

ATTENTION PLEASE!

Readers of Black Knowledge

INSERTIONS IN BLACK KNOWLEDGE

This week you receive the **Table of Contents for Volume 13,** and the **Title Page for Alphabetical Volume 4 (A-Z).** Next week you will receive the **Index for Volume 12.**

You will continue to receive tables of contents at the beginning and indices at the end of each volume.

In No. 150 you will receive a **Comprehensive Table of Contents for Volumes 1-12,** arranged in alphabetical order and with volume numbers as well as page numbers given for easy reference. Do not bind this comprehensive table of contents; it will eventually be replaced by another covering Volumes 1–16.

In future, all announcements about insertions will appear on the inside of the front cover of *Knowledge*.

Readers of Yellow Knowledge

INSERTIONS IN YELLOW KNOWLEDGE

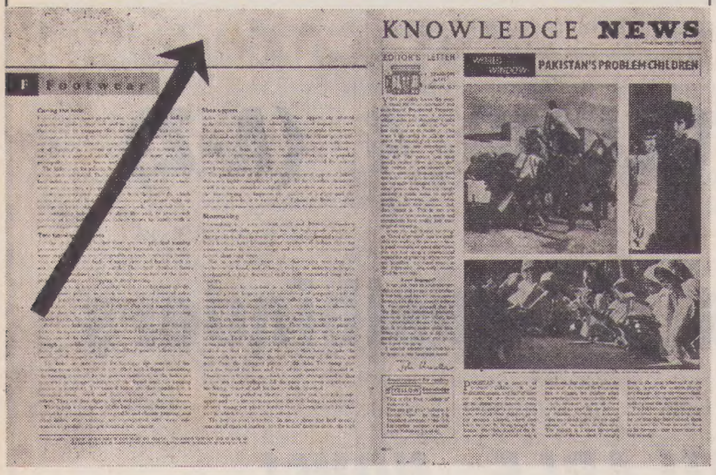
In four weeks' time, inside *Knowledge* No. 96, you will receive the **Table of Contents for Volume 9** and the **Title Page for Alphabetical Volume 3 (OR-Z);** inside No. 97 will be the **Index for Volume 8.**

You will continue to receive tables of contents at the beginning and indices at the end of each volume.

Inside No. 100 you will find a **Comprehensive Table of Contents for Volumes 1-8,** arranged in alphabetical order and with volume numbers as well as page numbers given for easy reference. Do not bind this comprehensive table of contents; it will eventually be replaced by one covering Volumes 1-12.

In future, all announcements about insertions will appear on the inside of the front cover of *Knowledge*.

WATCH THIS SPACE!



In future, all announcements about insertions in Knowledge *will appear in this space – along the top of the inside front cover of* Knowledge.

Information about binders and how to get them will also appear along the top of the inside front cover of 'Knowledge'. As soon as binders for any volume are obtainable, an announcement will appear in this space.

All binders can be ordered from your newsagent, or, in case of difficulty, write to Department B, 'Knowledge', 37 Hertford Street, London W.1.

AVAILABLE SOON TO READERS OF YELLOW 'KNOWLEDGE': the binder for Alphabetical Volume 3 (OR-Z). Watch for the announcement in issue No. 96.

Solution to last week's CROSSWORD

ACROSS: 1, Orb; 3, Reach; 6, Sweet; 7, Aid; 8, Strangers; 11, *Ado*; 12, Idiom; 14, Posse; 15, Kos.

DOWN: 1, Oasis; 2, Bee; 3, Retentive; 4, Agate; 5, Hod; 9, Riots; 10, Sumps; 11, Alp; 13, Ink.

You write – thousands read!

You will have read on page one that this is the last issue of the present four-page, black-and-white 'Knowledge News'. At the beginning of January, 1964, you will find a much larger colour magazine inside your copy of 'Knowledge'.

There will still be an Editor's Column in which YOUR letters will be published. There will also be space for many more letters in each edition, and room for your photographs too. So please write and tell us about your ideas, your opinions, your hobbies, your country and its customs, what you like about 'Knowledge' and what you don't like. Also don't forget to send us your jokes. Please address your letters to: The Editor, 'Knowledge', 37 Hertford Street, London W.1.

Clock Watching

DEAR EDITOR—Seeing a puzzle in *Knowledge News* reminded me of one that I know.

There are two clocks: one does not go at all and the other one goes but loses one minute a day. Which is the more efficient?

The one that does not go at all is right twice a day, but the one which loses a minute a day is right only once in nearly two years. It takes 720 days to lose 12 hours and so come back to the right time. This proves that the clock that has stopped is in fact the more efficient of the two.

Alan Potter,
54 Bell Lane, Hendon,
London N.W.4.

Can you answer these?

1. How many lines are there in a sonnet?
2. Who were the three great English Romantic poets who died abroad: (a) in Italy in 1821; (b) in Italy in 1822, following a boating accident; (c) in Greece in 1824, of rheumatic fever after fighting for the Greeks?
3. What sort of poems are Virgil's *Aeneid* and Homer's *Iliad*?
4. Most English poetry is 'iambic'. What does this mean?
5. Who wrote *Hiawatha*?
6. What Hebrew poems are sung in translation every Sunday in Christian churches?
7. Which is more important in English poetry, rhyme or rhythm? How do you know?
8. What is 'doggerel'?
9. Why are some poems called 'lyric'?
10. Just over a century ago Francis Turner Palgrave edited his anthology of English poetry, a work still highly regarded. What did he call it?

ANSWERS

1. 14.
2. (*a*) *Keats;* (*b*) *Shelley;* (*c*) *Byron.*
3. *Epics.*
4. *It contains 'feet' which have an unstressed syllable followed by a stressed syllable.*
5. *Longfellow.*
6. *The Psalms.*
7. *Rhythm; much of our very best poetry (blank verse) does not rhyme.*
8. *Verse of a low quality, often humorous.*
9. *Because of their musical or song-like quality, after the lyre – a musical instrument.*
10. *The Golden Treasury of English Songs and Lyrics.*

The Phoenicians in Malta

DEAR EDITOR—In the first issue of *Knowledge* there is an article about the Phoenicians. It is interesting to note that in 1500 B C the Phoenicians were already starting a colony here in Malta.

The great historian Diodorus Siculus, who lived at the time of Augustus, gave this description of the Phoenicians in Malta:

'The inhabitants are very rich; artisans of every class are to be found amongst them and the most expert are such as make textiles, famous for their fineness and softness. Their houses are very beautiful and ambitiously adorned with cornices and stucco works. It is a colony of Phoenicians who, extending their operations as far as the ocean in the west [the Atlantic], considered Malta a place of refuge on account of the excellence of its harbours and its situation in the Mediterranean.'

Several Phoenician inscriptions have been found in Malta, but the most remarkable was the one, written in both Greek and Phoenician, on the base of two columns. These columns were discovered in 1697 at Marsaxlokk, on the site of a temple to Mulqart, the sun god. One column is in Valletta museum and the other is in Paris, where it was sent as a gift to King Louis XVI of France.

This bilingual inscription is world famous because it gives the key to the Phoenician alphabet, just as the Rosetta stone revealed the secrets of the hieroglyphics of Ancient Egypt. The construction and grammar of the inscription are identical with the modern Maltese language, and many of the words are still in use today.

Alfred Vassallo,
31 St Rose Street,
Rabat, Malta G.C.

Medway Castle

DEAR EDITOR—In your Letter recently you talked about the different ways in which towns in Britain got their names. I would like to tell you how the city where I was born came to get its name.

In A D 490 Uske, the king of Kent, asked a chieftain called Roff to build a castle to guard the ford across the river Medway. The fortified town was known as Roff's Ceaster, and the name has changed over the years to Rochester.

Nicola Barnby (age 11),
150 Dover Road,
Walmer, Deal, Kent.

Motor Mad

'Name a large beast with a horn, boy.'
'An E-type Jaguar, sir.'

Robert Burnett,
2 Rossetti Road,
Corby, Northants.

A Little of What You Fancy . . .

Domineering landlady: 'How do you find your meals?'
Disgruntled boarder: 'With a magnifying glass.'

Salvatore Martingano (age 12),
2 Ledras-Praxitelous Street,
Nicosia, Cyprus.

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Many zoos are being rebuilt along the 'open-plan' lines of Whipsnade, San Diego in California, and Hamburg, with the animals living, wherever possible, in large open enclosures, attractively landscaped with rocks and trees.

The world's largest zoos (in terms of numbers of animals) are: Amsterdam, with its fine collection of tropical birds and animals from the Far East; Antwerp, with its rare Congo peacocks and magnificent collection of great apes; West Berlin, with its impressive breeding record; Frankfurt, with its group of rare dwarf chimpanzees, and its herd of gerenuks (among the most beautiful of all the antelopes); London, with its unique collection of small mammals and its famous giant panda 'Chi-Chi' (the only giant panda outside Russia or China); New York, the only zoo outside China which exhibits the takin (a heavily-built goat-like animal from the Himalayas); and San Diego, with its huge 'walk-through' aviaries, its colony of giant tortoises, and its large and varied collection of monkeys. All these zoos have well over a thousand different species of animals, and all are famous for their scientific research, their educational activities, and the work they do for conservation (helping to save the world's rare animals from extinction). In addition, there are many smaller zoos doing equally important research: Basle, in Switzerland, with its impressive record of breeding such rare creatures as the Indian rhinoceros, the pygmy hippopotamus, and the gorilla; Chester, with its island-colony of chimpanzees; Marineland of the Pacific, in California, with its games-playing dolphins; Phoenix, in Arizona, with the rare Arabian oryx; Copenhagen, the only zoo in the world which exhibits the rare Sumatran rhinoceros (smaller and hairier than other species) – and many others.

Dolphins are so intelligent that they need 'occupational therapy' to keep them alert and lively; here, the dolphins at Marineland of the Pacific play 'basketball'

A female okapi and her young; there is an adult pair in Bristol Zoo

Feeding the animals

Research into animal feeding plays a very important part in the running of a zoo, for without correct food many animals fail to breed and, in extreme cases, die of dietary deficiency. Grazing animals such as zebras, antelopes, and deer are fairly easy to keep, and do well on grass, hay, grain, and root vegetables; the large carnivores, such as lions, tigers, and bears, are also not too difficult since raw meat and bones are the basis of their diet, but even they need a variety of 'extras' such as grass, fur, and feathers to keep them healthy. But many animals have very specialised food requirements. Discovering what these are and providing for them can be quite a problem. Giant pandas live almost entirely on bamboo; a kiwi will eat 200 earthworms a day; anteaters have to have their food covered with formic acid as a substitute for live ants, if these are unobtainable in sufficiently

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Hamsters at the London Zoo live in vertical, glass-fronted 'burrows'

large quantities; small mammals have to have live insects; flamingos need fresh shellfish (otherwise their bright-pink feathers quickly fade).

There are many other problems too – some animals need more food during the breeding seasons, while others need less; some have to have a very varied diet, others need complicated vitamin and mineral supplements added to their food – the research worker's job is endless!

Living conditions

Suitable living conditions are also essential to the well-being of animals. Small, cramped, iron-barred cages will soon, it is hoped, be a thing of the past, though obviously the rebuilding of a zoo is a slow business.

At the London Zoo, before the new Elephant House could be built the Antelope House had to be pulled down and the antelopes moved. But before this could happen a new house had to be built for them, and the Giraffe House modernised: as in chess, each move has to be planned well ahead, and it all takes time.

In modern zoos, large animals such as giraffes, antelopes, the big cats, bears, and even monkeys are housed in spacious, barless enclosures, surfaced with earth rather than cement, and separated from the public by moats and low walls instead of bars.

In the same way, their indoor enclosures are also made as large as possible in order to provide maximum comfort for the animals and maximum viewing facilities for the public.

Small animals present rather different problems, for their needs are often much more specialised. At the moment, many zoos are working on the problems involved in keeping small mammals: burrowing animals need somewhere to burrow; climbing animals need branches to climb; swimming animals need water; gliding animals need plenty of space; nocturnal animals have to have special lighting conditions so that they become active during daytime. Already some kinds of burrowing animals such as hamsters are exhibited in the London Zoo in vertical, glass-fronted 'burrows', and the animals can be clearly seen gathering food above ground and carrying it down the tunnels to their nests and food-stores below. These hamsters are very interesting to watch, and are extremely contented.

A Galapagos tortoise hatching from its egg at the San Diego Zoo

Caroline, the London Zoo's Arabian oryx (now in Arizona), is one of the rarest animals in the world

Occupational therapy

Even if all their physical needs such as food, suitable living conditions, and companionship are satisfied, some of the more intelligent animals need 'occupational therapy' to prevent them from becoming bored. At the London Zoo the chimpanzees are given daily intelligence exercises; the elephants at the Basle, Hamburg, and St Louis Zoos are kept occupied with various tests and simple tasks, and at Marineland of the Pacific and other oceanariums the dolphins entertain themselves and the public by playing basketball.